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An investigation into the practicality of using a digital camera's raw data in print publishing applications

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An Investigation into the Practicality of Using a Digital Camera's RAW Data in Print Publishing Applications

by

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Table of Contents

List of Tables

Abstract

RAW file formats were introduced to the photography industry more than five years ago. However, not much information about their functionality, capabilities, or advantages in different situations has been made available. Some digital camera users are not aware of their existence and, if they were, they would not know what to do with them. RAW file formats functions are viewed as a concern of the professional photographer and not of the average user (Fraser, 2005).

RAW file formats are unprocessed digital image data – the type available from many current digital cameras. There is no standard RAW format. Each camera captures RAW data in a proprietary fashion. Thus, special camera-specific software is needed to access the RAW files. The widely used TIFF and JPEG file formats are processed within the camera right after shooting each image. TIFF files are uncompressed and therefore large. JPEG files are spatially compressed and smaller than TIFF files for images with the equivalent number of pixels. RAW file formats contain all the original data, uncompressed, with no adjustments to image sharpness, white balance, contrast, and saturation, but they are incomplete as images because they need to be processed using

either proprietary software provided by the digital camera manufacturer or other software such as Adobe® Photoshop® CS.

This study addresses the following research question: What is the real value, if any, of RAW file formats in magazine publishing? The author's intention was to learn about RAW file formats and what is currently being claimed about their advantages and disadvantages. Photographing using RAW formats is like photographing with negative film, only in digital form. Using RAW formats is much like preserving the analog format workflow, where after all of the images are captured on film, the film is sent out for developing before we can see the image. Using RAW files is similar to this process, but it is done by the photographer using a computer and not a film-processing machine. To do this the photographer or processor needs software that can interpret the RAW format image.

Research Method

This research was exploratory in nature. Information was gathered from experts who have experimented with RAW file formats, who have had direct involvement with digital photography technology, and who have sought to discover its capabilities and its practicality in the real world. This thesis also discusses topics such as the various types of digital cameras suitable for publishing work.

This study involved collecting data from interview sessions. Interviews were conducted with eight experts in the field of photography and publishing at Rochester Institute of Technology (RIT). (Interview questions are listed in Appendix I). Data analysis was based on information gathered during these interviews.

From the collected information, a list was created of the potential advantages of Camera RAW workflows in magazine publishing applications. The conclusion addresses possible advantages, as well as the practicality of using Camera RAW data in magazine publishing applications. A set of guidelines for future Camera RAW workflow users is also provided.

Conclusion

Based on the findings from the interviews, it is concluded that RAW file format usage is currently impractical in the magazine publishing environment. The RAW workflow would not be practical for photojournalism, where speed is more important than the quality of the image. Time, cost, and demands from clients contribute to these changes. Because there is no standard RAW format and because the photographer must spend extra time to process the images, the RAW workflow does not address the needs of magazine publishing. It might be practical to use in the future, after the RAW format has been standardized, and the RAW workflow has been perfected.

Endnotes for Abstract

Fraser, B. (2005). *Real World Camera Raw with Adobe® Photoshop® CS*. California: Peachpit Press.

Chapter 1

Introduction

There are two common file formats in digital photography: JPEG and TIFF. Most digital cameras are equipped with these two file formats. However, a few cameras have a third format: the RAW file format. RAW differs from camera to camera according to manufacturer.

Statement of the Problem

RAW file formats are best known to users of the "prosumer" and professional cameras (Fraser, 2005). However their workflow, capabilities, advantages, and handling are still not that well known, even to most professional photographers.

Magazine publication is a fast-paced industry where production depends on an efficient and accurate workflow for delivery of products on time and ahead of the competition. There is a question as to whether the RAW file format is more practical for use in the publishing industry than the JPEG file format. The RAW file format delivers higher quality than JPEG, which has some quality issues because of its lossy compression. However, JPEG delivers fast results that are satisfactory for certain

publications. It is also easy to handle by the photojournalist in the field who is working with a deadline. This research looked into the advantages and disadvantages of the RAW format and addressed the question of the practicality of RAW workflow in the publishing industry.

The results of this research may impact the digital photographers' workflow and the publishing workflow itself. Photographers and publishers might need to acquire new knowledge and equipment. These results may also, in the long run, impact the publisher's ability to reproduce images in various formats as needed. It is hoped that results gathered from this research will answer questions regarding the practicality of RAW file format usage in the publishing industry and that they will also provide guidelines and information needed by photographers and publishers who intend to use RAW workflow.

Background and Present Significance

Photographing using the RAW format is like shooting with negative film, only in a digital form. The RAW format provides a "digital negative" containing the untouched data as it comes off of the camera's CCD (charge-coupled diode) or CMOS (complementary metal oxide semiconductor) sensor (Whitley, 2004). Likewise, processing RAW images is like printing negative film in a darkroom, only the darkroom is digital. The RAW workflow is much like the analog format workflow using film, where, after image capture, the film is sent out for chemical processing before we can see the image. The difference is that the digital photographer must use a computer rather than

a film-processing machine and this means that the photographer or photo processor needs computer software that can interpret the RAW format images. Sometimes the necessary software comes bundled with the digital camera. If it does not, one can use graphic software like Photoshop® CS to process the RAW files using Camera RAW. Why would photographers spend this much time to process the images? Is the end result as good as the result from negative film? Do publishers really need pictures in RAW file formats for their publications?

When comparing RAW to JPEG and TIFF formats, one of the most important questions concerns the differential in processing workflow, processing time, and compatibility with the printing process. Is an imaging workflow based on the RAW file format useful in the publishing industry? The literature review showed that there has not been enough research done on the subject to provide an answer. Knowledge of the RAW file format's advantages and disadvantages may help publishers make the best decision regarding the implementation of RAW.

The Reason for Interest in the Study

Having worked in a publishing and printing company, the author understands the publishing workflow well. Direct involvement in implementing the use of digital cameras in the photography division of Kumpulan Karangkraf Sdn Bhd made the author aware of RAW file format use in magazine publication. Whether or not to use RAW in a publishing context had been the author's dilemma since her first experience with the

format. In publishing, time and cost are big issues. Implementation of new technology that will cause major setbacks in manufacturing time will not benefit the publisher. Publishers should be equipped with knowledge about RAW workflow before adding it to their existing workflow. Professional digital cameras are equipped with three file formats: TIFF, JPEG, and RAW. With publishers investing large amounts of money in digital photographic equipment, it would make sense to use all of a digital camera's capabilities, including the RAW format. The author's interest in this study leads to the question of the practicality of using a digital camera's RAW data in a print publishing application. Will it benefit the publishers? Will it bring any positive difference to the publishing workflow?

Endnotes for Chapter 1

Fraser, B. (2005). *Real World Camera Raw with Adobe® Photoshop® CS*. California: Peachpit Press.

Whitley, M. K. (2004). *My Canon RAW workflow*. Retrieved June 13, 2004, from http://www.mkwphotography.com/workflow.htm

Chapter 2

Theoretical Basis of the Study

The Theory

RAW file format usage is said by some to be suitable under any conditions and for any end product, such as newspapers, magazines, photographic paper prints, billboards, advertising, and a few others. Is RAW really suitable in any situation?

There has been much commentary among professional photographers about the use of RAW. Some professional users say that if a person is interested in producing the best quality images, that person must shoot RAW. Opponents to this view say that there is no point in shooting RAW, because one can get equally good results from shooting TIFF or JPEG. One cannot escape the fact that image quality matters, especially when images are to be reproduced in print formats. However, what about situations in which quality is not the main issue, as in photojournalism, where getting the image for the story is more important than the quality of the image?

Digital Photography

The birth of digital photography changed the pace of the publishing industry workflow. Using this new technology, photographers and photojournalists can produce images faster, at lower cost, and with less preparation needed for publication. The use of digital photography by publishing houses that produce magazines biweekly, weekly, and monthly has helped save a great deal of time and money. One of the most important steps in handling analog images in publishing is the high-end scanning process, which produces high-quality images with the use of color management. JPEG images produced by digital cameras are said to have far less information than scanned analog images. It is claimed that RAW produces the highest quality images, which are suitable for any workflow (Fraser, 2005). Does the highest possible quality really matter in the publishing industry?

Endnotes for Chapter 2

Fraser, B. (2005). *Real World Camera Raw with Adobe® Photoshop® CS*. California: Peachpit Press.

Chapter 3

A Review of the Literature in the Field

Introduction

RAW file formats were introduced to the photography industry more than five years ago. However, not much information about RAW's functionality, capabilities, or advantages in different situations has been made available. Some digital camera users are not aware of its existence in the camera and, if they were, they would not know what to do with it. RAW file format functions are viewed as a concern of the professional photographer and not of the average user (Fraser, 2005).

The author had difficulty in gathering information on the RAW file format. Few formal articles or books have been written about its application, capabilities, functions, advantages, handling, or suitability. Most of the information found was in the form of reviews or "blogs" written by professional and amateur photographers who have been using RAW all the time, using it only occasionally, or experimenting with it. Most of these reviews are based on personal experience, and some information may not be accurate.

The RAW File Formats

RAW file formats are uncompressed and unprocessed data files produced by a camera (Microsoft Corporation, 2004). A RAW file is known as a digital negative (Reichmann, 2004). It works like a negative film, which, after exposure, one has to process before images can be seen or used. After a picture is shot in the RAW format, the image must be converted or processed to produce a JPEG or TIFF file using file conversion software. RAW file formats are suitable for use by people who intend to spend a lot of time adjusting images to their satisfaction. It is not meant to produce images for use on the spot (Rockwell, 2004).

> RAW is not one single thing, it is actually a general term for a variety of proprietary file formats – such as Canon's .CRW and .CR2, Minolta's .MRW, Olympus' .ORF, and Nikon's .NEF… that share important common features (Fraser, 2005, pp. 2).

Professional and amateur photographers have written reviews on the application of the RAW file format for personal use. Most of the reviews recommend the use of RAW and suggest when and for what purpose to use it. Most users claim that they use RAW because they can control the outcome of their images. Most also claim that RAW is the best image format to use if one wants to get the best possible pictures from the digital camera. However, not all cameras have the RAW option, especially lower priced consumer cameras. With RAW, one can set the white balance, color correction, levels,

sharpening, and other parameters when processing the image, using software such as Photoshop® CS or other software supplied by the camera manufacturer (MaranGraphics & Wiley Publishing, 2003). The camera will not apply any of these settings to the image during RAW file capture. However, one has to have knowledge of color management in order to produce the desired final output. Adjustments in white balance, color correction, and other settings will not take effect if there is no color management applied during the printing process. Before the introduction of Adobe® Camera RAW, users faced problems in dealing with RAW format images. Most proprietary software that comes with cameras is very slow, and sometimes it will not work at all. Adobe® Camera RAW, however, can process files rapidly, and unlike proprietary software, it can read most RAW formats. With the workflow built in Photoshop® CS, Adobe® Camera RAW has become the main choice for the RAW conversion (Milburn, 2004).

Many photographers like to use RAW file formats because they can exercise their creativity after the photo shoot in a way that is equivalent to using an analog camera. Many choose the RAW format because the file is smaller than a TIFF file but still preserves all of the image information. Some advise using RAW if a person is not sure about the camera exposure, because, technically speaking, with RAW one can always adjust the white balance later and still produce a good image. One disadvantage is that it takes a lot of computer processing time to convert RAW data. Some software will re-process an image every time the user makes an adjustment, for example, changing the white balance. The re-processing of images during adjustments costs time. In some cases,

it may take around 70 seconds to process one RAW image (MaranGraphics & Wiley Publishing, 2003). If a person has thousands of images to process, it could take days to finish. The slow image processing is due to the size of the RAW file. Currently, a lot of cameras that capture RAW provide the option of simultaneously capturing a JPEG. The downside to this option is that it increases the write time, because the camera has to write two versions of the file to the card (Milburn, 2004).

Shooting RAW format images for magazine publication can cause difficulties for photographers, because they cannot work as fast as they could if they were shooting with JPEG. The primary disadvantage of shooting RAW formats is that RAW images are always larger than JPEG images. After shooting a burst of images the photographer has to stop taking pictures while the camera writes the RAW files to the internal memory (Eismann, 2003).

When most people talk about taking digital photographs, they are talking about fast, low-cost, point-and-shoot, ready-to-use images. These are attributes of JPEG or TIFF formats. RAW images, on the other hand, require additional processing, which some may see as a step backward to analog methods (Fraser, 2005).

Digital Photography in Publishing

Using digital photography, photographers and photojournalists produce quality images faster and at lower cost than conventional film-based photography, and, because

the images require less work to prepare for publication, publishers are able to get their products out into the market faster. Photographers and photojournalists can send images for last-minute news via the Internet, which they could not do when they were using the analog camera. Digital camera usage has eliminated the need for chemical film processing, scanning, and retouching in the publishing workflow, because the digital images are ready to use after they are transferred from the storage card (Kleper, 2001).

Because time and money are big issues, publishers must focus on reducing costs and speeding up production. Digital photography has made it possible to produce high-quality images that are ready to use in multiple publications. It also maintains picture quality, because digital images are not affected by problems such as fingerprints, dust, and scratches, which can compromise the quality of slides or color prints. Graphic designers need to do less touchup on digital images. They can start working on images as soon as the photographer transfers them to the computer, without having to wait for chemical processing (Kleper, 2001).

With constantly improving technology, more and more publishing houses are trying to upgrade their equipment in order to compete. Some of the most crucial decisions that publishers must make are related to the technology and workflow of digital photography. The publisher's main objective is to capture images when and where events occur and to use them immediately, especially for daily publications, such as entertainment tabloids.

The Purpose of Using a Digital Camera

The main purpose of using digital photography in publishing is to minimize the cost, time, and errors associated with analog photography. Digital camera functions can be preset to automatically adjust parameters such as white balance, contrast, saturation, image attribute adjustment, sharpness, and much more (Kleper, 2001).

Digital photography has helped reduce processing time and has simplified publishing workflows. Digital cameras are easy to handle by photographers and photojournalists. Users can identify images as good or bad right after shooting by looking at the display screen. While it is not 100% accurate, this function gives assurance to photographers and photojournalists working in the field (Fraser, 2005).

Image Format

The publishing workflow requires specific images delivered on time and with a level of quality that is appropriate for the end product. It was the aim of this study to determine whether it is advantageous to use the RAW file format for digitally captured images and under what circumstances it would enhance the quality of printed images in magazines.

RAW is currently a topic of heated discussion among photographers. The author analyzed the responses of working professionals and attempted to establish objective guidelines for the use of RAW capture workflows in magazine publishing applications.

One of the reason photographers choose the RAW file format is that it records everything the image sensor in the camera sees. It also gives the photographer the freedom to choose the color balance, highlights, shadows, level of sharpening, noise reduction, and many other attributes for each image. RAW also captures more bits of data in an image (from 10 to 16 bits of color, depending on the camera), which means that it provides billions of shades of colors while JPEG captures 8 bits of data which gives millions shades of color. RAW formats give users more data to work with than JPEG.

Summary of the Literature Review

Table 1.0 summarizes the advantages and disadvantages of RAW file formats in magazine publishing applications. Unlike JPEG, RAW images need to be processed before they can be used. RAW images provide better quality because they are uncompressed and unprocessed, giving the processor more data to work on during processing. To start using the RAW workflow in a publishing house would require a huge investment in digital cameras, software, color management software, powerful computers, and training for photographers.

Table 1.0:
Advantages and Disadvantages of RAW File Formats in Magazine Publishing Applications

Advantages	Disadvantages
1. Can produce multiple genuine effects on a single image 2. Can adjust images according to desire, based on studio shooting 3. No application of effects on the images during shooting 4. Can correct image in processing in case of overexposure or underexposure to a certain degree higher than a JPEG file 5. Captures more data and more details 6. Provides photographers the freedom to create their own image preference	1. Need to process images 2. Processing and changing of white balance images in Camera RAW does not represent actual scene 3. Software needed to process images 4. File takes time to process 5. Have to determine white point when processing 6. Problems with different types of processing software 7. Takes time to record images in memory card after every shot 8. Cannot get results right away 9. RAW file size almost as big as TIFF 10. Photographer or user needs knowledge of color management to assure quality in final output 11. Big investments – professional digital cameras, software, color management software, powerful computers, courses for photographers.

RAW provides advantages in terms of the freedom to adjust images as desired. Because the RAW image contains more data, a photographer can correct the image in processing in case of overexposure or underexposure. This is usually not possible with a JPEG image. However RAW also has a lot of disadvantages. A RAW image needs to be

processed before it can be used. Another problem is that various kinds of processing software provided by the camera manufacturer sometimes do not provide users with the desired result. RAW files are larger than JPEG and require a bigger and faster storage card. Users need to know about the advantages and disadvantages of RAW before making the decision to start using RAW file formats for their work.

Endnotes for Chapter 3

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Chapter 4

Methodology

This research was exploratory in nature. Information on RAW was acquired from professionals who are working directly with these formats. The author's aim was to gain the perspective of educators, experts, and users who have applied RAW workflow in their work, have worked and experimented with RAW file formats, have been directly involved in digital photography technology, and are familiar with Camera RAW and other RAW processing applications. The interviewees have first-hand knowledge in technology and development of RAW file formats, have been involved in beta-testing of software and equipment in relation to RAW, and know RAW capabilities and its practicality in the real world. This particular demographic group has expertise in this area, which has existed since the introduction of digital cameras and RAW file formats. The interviews for this research were limited to experts at Rochester Institute of Technology (RIT). Information was also gathered from books, the Internet, magazine reviews, and white papers.

Data Collection Plan

The study was based on interviews and information gathered from primary and secondary sources. Data were collected through interviews with experts in the photography and publishing field at RIT. Eight experts were interviewed. Interview questions are listed in the Appendix. Secondary data was also collected from books, the Internet, magazine reviews, and white papers. This study is limit to the magazine publishing application due to publisher's vast interest in the digital photography technology and RAW file formats.

Data Analysis

The information gathered from the interviews was analyzed, and the author has transcribed selected portions of each interview that contain interesting insights into the use of Camera RAW file formats. Experts' responses to each of the interview questions have been summarized. From the collected interviews and the primary data, a list has been created of the potential advantages of Camera RAW workflows in magazine publishing applications. The author has evaluated the summarized responses to each question on the basis of her own extensive experience with and understanding of the image input requirements for common categories of magazine publishing. The conclusion addresses the possible advantages as well as the practicality of using Camera RAW data in magazine publishing applications. It also provides a set of guidelines for future RAW file format users in the publishing industry.

Chapter 5

The Results

Summary of Interviews with Experts

Information gathered from the interviews reflects the experts' opinions on whether the use of RAW file formats is practical in magazine publishing applications. Information gathered from all interviewees was compiled and summarized. The experts interviewed are involved directly with digital photography and RAW. Note: For this thesis research, the author has the interviewees' permission to reveal the biographical material and to quote parts of their responses to interview questions.

Experts' Background

Greg Barnett

Greg Barnett has worked at RIT for 25 years and currently is the Director of Operations in the College of Imaging Arts and Sciences. He has been involved with digital photography since its commercial introduction in the 1980s. He has watched and participated in the evolution of the technology from its early roots in still video to today's highly advanced digital capture systems. As the concept of RAW capture began to take hold, he became involved with Adobe Camera RAW. Barnett worked with the first beta

version of Adobe Camera RAW, which was introduced in version 7 of Adobe Photoshop. Since that time, he has become an acknowledged expert in Camera RAW workflow and has taught the subject to both faculty and students at RIT. He also has consulted with several photographers and commercial businesses on the adoption of RAW workflow and digital photographic workflow automation. He is a member of the Adobe Photoshop CS2 beta team and has actively participated in the development of version 3 of the Adobe Camera RAW plug-in.

Patricia Russotti

Patricia Russotti is an Associate Professor in the College of Imaging Arts and Sciences at RIT. As a member of the RIT faculty since 1981, Russotti has educated students in all aspects of traditional and non-traditional photography, image capture, image manipulation, and image correction along with digital output processes. Russotti places a particular emphasis on how to teach technology and its applications. Russotti is an active digital and photographic imaging artist producing a wide range of work for corporate and private clients. She also provides digital imaging consulting services.

Douglas Ford Rea

Professor Douglas Ford Rea has been a member of the RIT faculty since 1976. Prior to that, he was a professional photographer. Since joining RIT, Professor Rea has had over thirty exhibitions of his photographic work. He lectures extensively on topics in digital photography and computer imaging. In addition to his teaching responsibilities at RIT, Professor Rea has produced two live, internationally broadcast teleconferences on

electronic photography. Rea is also very active as an industry consultant. He frequently presents seminars and custom programs on related projects. Rea is President of the recently established PixelWing Technologies, Inc., which designs new capture and editing technologies for wireless imaging. He also shoots photographs for news agencies and motor sports interests.

Michael P. Riordan

Michael Riordan is an Assistant Professor at RIT's School of Print Media where he teaches coursework relating to color, premedia, and print production workflows. Since joining RIT in 1998, Riordan has been involved extensively with high-end image capture systems, color proofing, color management, and related premedia production. Through his research at RIT, he has specialized in streamlining premedia workflow practices. He works closely with publishers, print service providers and creative agencies to help assess and optimize their production environments. Riordan provides training and consulting on related topics and is a regular presenter at industry events such as GraphExpo.

Susan Lakin

Susan Lakin is an Assistant Professor who has worked for five years in the School of Photographic Arts and Sciences at RIT. Lakin has been teaching digital technology for eight years and recently has been incorporating digital capture in her courses. She has a BFA in photography and an MFA in Art Studio from the University of California, Santa Barbara.

Dr. Franziska S. Frey

Franziska Frey is an Assistant Professor in the School of Print Media at RIT. She teaches courses in materials and processes for printing, image database design, and digital asset management, and is also involved in research projects in the Sloan Printing Industry Center at RIT and the Munsell Color Science Laboratory. Frey is also a member of the faculty in the Mellon Advanced Residency Program in Photograph Conservation at George Eastman House, International Museum of Photography. Frey received her Ph.D. degree in Natural Sciences (Concentration: Imaging Science) from the Swiss Federal Institute of Technology in Zurich, Switzerland in 1994. Before joining the faculty, she worked as a research scientist at the Image Permanence Institute at RIT, where her work focused on establishing guidelines for the viewing, scanning, quality control, and archiving of digital images. Frey publishes, consults, and teaches in the U.S. and around the world on various issues related to establishing digital image databases and digital libraries. She is also involved in several international standards groups.

Douglas Manchee

Douglas Manchee is an Associate Professor in the College of Imaging Arts and Sciences at RIT. He has worked at RIT for 14 years and has been teaching digital photography since 1993. He has been using digital photography exclusively for his work since 2000. He has worked with RAW files for about two years, starting with the earliest version of Adobe's Camera RAW software. Manchee believes that recent advances in the processing of RAW files will greatly accelerate the acceptance of digital imaging into his field of advertising/commercial photography.

John Retallack

John W. Retallack is a tenured assistant professor in the Photographic Arts Department of RIT's College of Imaging Arts and Sciences. He is currently working on a series of photographs of the residents of Monroe Community Hospital, a health care facility in Rochester. The thesis of his work is the irrepressible human spirit. Retallack traveled on sabbatical to Moscow in 1992, sponsored by The Russian Fine Art Photographers Union; while there he had the opportunity to photograph Moscow and the 1992 May Day events. Retallack has been a member of the American Society of Media Photographers since 1974, currently serving on the governing board of the Western New York Chapter, an elected position. Prior to entering the teaching profession, Retallack worked in Manhattan for 12 years as a freelance photographer specializing in advertising photography.

Experts' Preferences

Each expert a preference for the type of file format and workflow that is appropriate for his or her own photography work. Table 2.0 reflects the choices of these individuals based on need, function, workflow, and personal preference.

Table 2.0:
Experts' Preferences

Preferences	YES	NO
Used JPEG and TIFF before RAW	8	0
Have totally switched to RAW	5	3
Prefer RAW workflow for all photography work	5	3
Choose RAW over JPEG	6	2
Use RAW for publishing workflow	6	2

Use of JPEG and TIFF Before RAW

Most of the interviewees used JPEG and TIFF formats before the introduction of RAW. These are the common file formats known to digital camera users, and they are suitable for most computer platforms. The persons interviewed were mostly satisfied with the images provided by JPEG and TIFF. The only issues that they all agreed on is the lossy compression in JPEGs and that problem may be overcome by using the TIFF format. However, TIFF is usually a larger file and takes longer to save to a storage card. People use the JPEG format because it produces satisfactory images quickly. All of the settings, such as white balance, are done automatically within the camera, so users do not have to worry about getting a bad image. However, some experts agreed that knowledge of photography and photography techniques is needed even though the technology has changed. The primary difference is that in digital photography the image is captured on a CCD or CMOS and stored on a card and not on film.

Image quality is different for each file format. Some professional photographers used JPEG images not for printing purposes but for presentations and web pages. For images intended for offset printing publication and inkjet printing, TIFF was considered the next best choice.

Why Switch to RAW?

The experts agreed that during the early days of digital photography, professional photographers expressed negative feedback on the image quality and functionality of the digital camera. Acceptance of the technology was very poor. However, the technology quickly changed the way people look at photography. Publishers and newspapers quickly adapted to the technology because it shortened the production workflow. By eliminating film usage, companies eliminated raw material costs for films, time for chemical processing, and the high-end scanning of images.

Most of the experts agreed that RAW formats give them the freedom to shape their images as they want them. It puts craftsmanship back into the creation of images. The photographers want to be able to manipulate images creatively and still produce a high-quality result. RAW is unprocessed and uncompressed data. It captures maximum image data on location and lets the processor determine how much data they need for final output. Interviewee John Retallack stated, “When I open a RAW file, I have many options in terms of color balance, ISO, and contrast. When I open a JPEG file, I don’t

have any option. It is what it is" (J. Retallack, personal communication, January 25, 2005).

The experts agreed that RAW should be used when there is a possibility that the images will be repurposed or used for various products and when you do not yet know what your type of output is going to be. These points apply to work done in the professional environment. A RAW file functions like a negative film that allows you to produce high-quality images in different form. Interviewee Doug Manchee stated, "A RAW file is basically a digital negative. If [users know] that they would want to repurpose the images for different usage, they should use RAW. It is very important to have the ability to process the RAW information to suit various purposes" (D. Manchee, personal communication, January 20, 2005). Interviewee Doug Rea stated, "Some of the time I don't really know what my output is going to be, so I shoot RAW because I want all of the addressable data there. If I would like to manipulate the data for a specific tone reproduction, there will be no posterization to the image" (D. Rea, personal communication, February 3, 2005). In a publishing environment, images produced by the photographer usually are used in various products with different quality requirements.

A lot of RAW file format users are still learning about what RAW really is and how to use all of the tools provided in RAW converter applications such as Adobe Camera RAW. Basically, one has to understand the benefits of using the RAW file formats and know when to use it.

> I use RAW sometimes but I use RAW very cautiously. More often I use JPEG because it is more efficient and because I go towards publishing workflow. RAW features such as white balance (color temperature) are nice if you know what to adjust to but, if you shoot it right in the first place, you won't have to adjust white balance at the RAW stage (M. Riordan, personal communication, January 18, 2005).

Differences Between JPEG and RAW

Information gathered from the experts stated that JPEG and RAW file formats both start with raw image data. The difference is that JPEG images are processed automatically in the camera right after capture, whereas RAW images are manually processed off-camera via a RAW conversion application using the photographer's setting preferences. JPEG images are produced quickly, have a small file size, and are acceptable to most users. RAW images are large, and data transfer is slower than with JPEG. Table 2.1 outlines the comparison between JPEG and RAW capture.

Table 2.1:
Comparison Between JPEG Capture and RAW Capture

JPEG Capture	RAW Capture
- Compressed images – lossy compression - Small file size - 8-bit data - Not much data to work with - In-camera image processing (ready to use) - Images can be use to the maximum depending on original settings of the image	- Uncompressed images - Large file size - 16-bit data - A lot of data to work with - Can reprocess indefinitely - Choice of white balance - Craftsmanship can be part of image processing - Need off-camera image processing (images not ready to use) - Images can be repurposed for different product requirements

RAW file formats provide users with more choices. Interviewee Doug Rea stated, "Addressability is what it comes to. It's really the quality issue in terms of color reproduction, noise reduction, and tone reproduction" (D. Rea, personal communication, February 3, 2005). In a sense, the RAW file is just the data coming out of the camera with no processing. It comes with proprietary tags delivered from the camera for white balance. This is different from a JPEG file, which is completely processed and compressed in the camera. The user will not lose any data when processing a RAW image, but excessive manipulation of a JPEG image is destructive. Anything users do to a JPEG file will involve a certain amount of degradation of the data.

Interviewee responses:

> Here's what I look at in terms of RAW: I have addressability in terms of tone reproduction, in terms of gray balance, and the overall white point. I'm also looking at workflows that allowed image interpolation that's built into the acquire mode (D. Rea, personal communication, February 3, 2005)

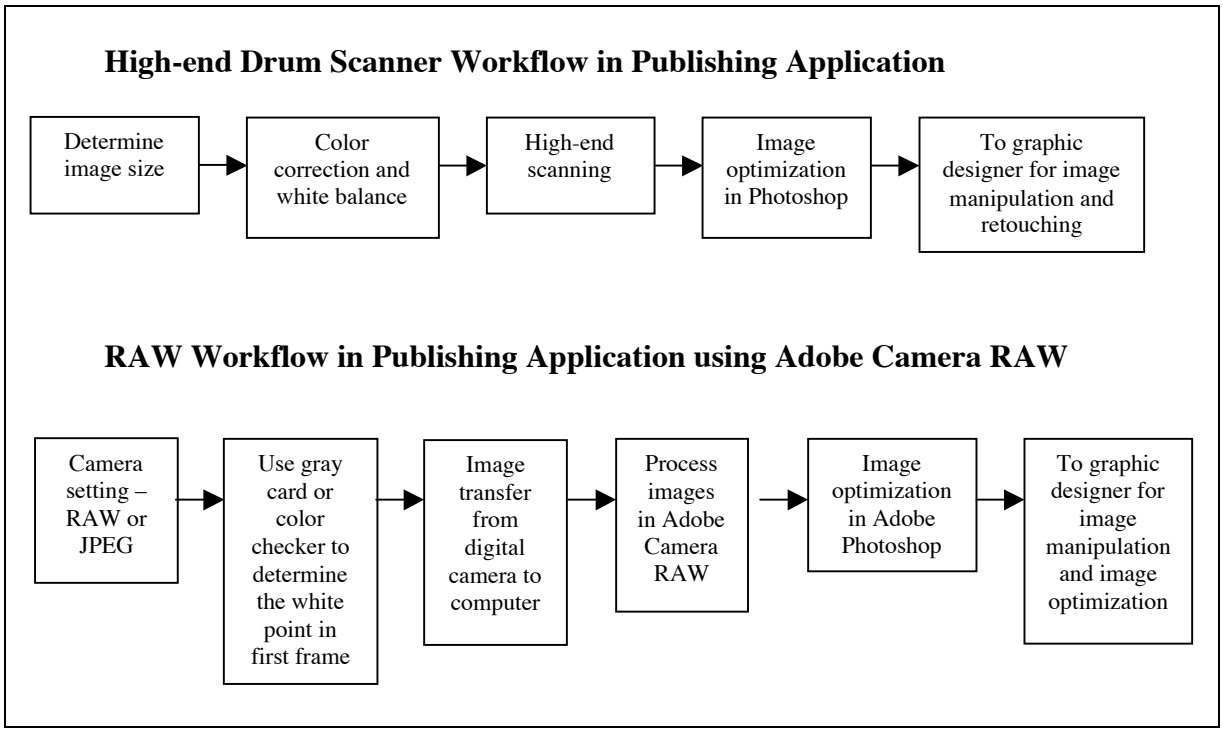
> It's to a point where RAW gives you more versatility. But if you don't have details and highlight then you won't have details and highlight. If you blow them out (the highlights in a RAW file), then you can't get them back. So you still have to acquire good exposure and then you can repurpose it depending on what you're using it for. You have the flexibility but you have to capture a good image. Even if you are using a JPEG image you still have to get exposure, detail, highlight and get a healthy looking histogram. That's definitely important no matter what you decided to acquire the image with (S. Lakin, personal communication, January 25, 2005).

Some experts commented that, from a pragmatic standpoint, RAW is not suitable for photojournalism work and that JPEG is the best choice. The reasons are that JPEG images are faster to capture, are ready to use within the existing workflow, use less storage space, allow fast file transfer, and are exactly what the photographer wanted because all of the information is embedded in the image through in-camera processing. Thus, the photographer will not have to worry about other people adjusting their images after they have been wire-transferred.

Comparison Between RAW Workflow and Drum Scanner Workflow

It is important for conventional professional photographers who plan to use RAW workflow to understand how it operates. Some experts agreed that the RAW workflow is similar to a high-end drum scanner workflow (see table 2.2). In the RAW workflow, the photographer needs to determine the size of capture in the camera setting before taking photographs: that is, he or she must choose the most suitable file format. The same is true for a photographer who is using film. He or she must determine the size and type of film needed based on the end use of the images and the type of job it is. A gray card or a color checker must be used to determine the white point. In a scanner workflow, the white point reading is taken from the image or from another white point before the scanning process begins. Most professional photographers working in the publishing industry know or have some idea of how a high-end drum scanner works. Showing the comparison with the RAW workflow will provide users with a better idea of how RAW format works.

Table 2.2:
A Simple Analogy of RAW Workflow to a High-end Scanner Workflow



What Can Be Done with a RAW File that Cannot Be Done with a JPEG File?

As stated previously, the experts agreed that RAW provides some advantages over JPEG, especially in terms of repurposing of images and image quality. A single RAW file can be multi-purposed for different quality levels of publication ranging from a web image to a high-quality halftone reproduction. A JPEG file will be limited to the maximum capture size for reproduction and any manipulation to the image will negatively affect the image quality. A JPEG file is not meant to be heavily processed but to be used as it comes out of the camera. A RAW file, like a roll of film, can be processed as needed. The digital processor, like a film processor, could add an extra stop of exposure for push processing during the RAW conversion process. Alterations to the

image can be made as many times as necessary by going back to the original linear data. Most of the experts decided to use RAW because it offers the possibility of both creative and technical control. Interviewee Doug Rea stated, "You have the peace of mind to know that you can always go back and address a truly digital negative – a digital original. There's a sense of confidence that I get when facing a difficult lighting situation, and I don't have time to do a custom gray balance. If I don't have a gray reference in my scene, I can still address those values" (D. Rea, personal communication, February 3, 2005).

Choice of RAW Processing Application

Adobe Photoshop is a known image editing application in the graphic arts industry. With the introduction of the Camera RAW functions, Adobe has introduced another supporting application into the digital imaging world. Its use has been widely accepted among professional and non-professional users. All of the experts interviewed have chosen Adobe Camera RAW as their preferred RAW image converter over their camera manufacturer's software. It is said that Camera RAW functions are better and faster than proprietary camera software, and the RAW workflow is already built into the Adobe Photoshop CS application. Interviewee Michael Riordan stated, "The main reason I chose Adobe Photoshop for RAW conversion is because it doesn't require any extra plug-ins and it is not proprietary" (M. Riordan, personal communication, January 18, 2005).

> I'm not saying that [Adobe Photoshop] has the best 48 bit acquire mode. There are several good software solutions out there, but the workflow is already built in the Adobe

> Photoshop CS. The C1 [Capture One] software from PhaseOne has some advantages in some directions. The problem is if you use C1, you still have to go back to Photoshop CS. If you are a photojournalist, you won't have time to go on to C1, access the RAW files, and then go to Photoshop (D. Rea, personal communication, February 3, 2005).

Differences Between Cameras for RAW Files Converter

There are big differences among cameras on various levels. It is important that users understand that each camera manufacturer uses a different proprietary RAW formats, Canon RAW is different from Nikon, Olympus, Fuji, Kodak, and others. These differences create problems, as there is no standardized RAW format. In terms of processors or RAW converter applications, there might be a slight difference in the workflow, but there is no difference in image quality. Interviewee Greg Barnett stated, "The main difference is the quality of the camera itself and the size of the capture. It's the sensor itself that's in the cameras, the quality of the sensor – how many pixels, the dynamic range of the sensor, the electronics of the camera in terms of the noise reduction processing… so there are a lot of different factors that go into determining that quality" (G. Barnett, personal communication, January 20, 2005).

Some of the experts interviewed had the opportunity to work closely with developers of RAW converter applications or RAW workflows such as Adobe Systems Incorporated. The Adobe Camera RAW input program can read most proprietary RAW file formats. Camera RAW is used widely among the experts and professional photographers because it is conveniently included in the Adobe Photoshop application.

After converting a RAW file, most users will open the image using Adobe Photoshop to do image enhancements and other manipulations. Another Adobe application is the Digital Negative Converter, which is predicted to be the standardized RAW translator for all camera manufacturers in the future.

RAW Format Advantages

Professional photographers are seeking better quality, flexibility, and artistic control of digital images through RAW format images. Interviewee Doug Rea stated, "As a photographer I want control of my images. When you have a RAW file, it's like having a transparency. It's like having a high quality negative" (D. Rea, personal communication, February 3, 2005). As stated previously, the photographer may treat a digital image like negative film, to have more control over the images, and to be able to process it over and over again from the original image. RAW format images provide photographers with the tools they desire. RAW images give access to 16-bit data for a greater image detail.

All of the experts agreed that user control and image quality are the main reason's they choose RAW formats. Users can achieve far superior quality from RAW than from JPEG because the RAW file is uncompressed and it is essentially untagged. With RAW, users have the ability to alter the metadata and color-manage it before it is exported to TIFF or JPEG.

RAW Format Disadvantages

One of the main disadvantages of RAW file formats is that it is not ready for use out of the camera; the user must process the images in order to use them. This is a significant issue in situations where deadlines are critical. RAW files are also larger and write more slowly than JPEG files. The larger RAW files require a bigger storage card and more time for image download. One expert said that the RAW formats were designed for an upper-level, semi-professional photographer who might understand the tools provided in RAW. This expert also stressed that the use of RAW formats puts the burden back on the photographer or image processor to make additional decisions.

Interviewee responses:

> Because I come from a printing background, I look at RAW conversion in terms of its efficiencies. From a business standpoint, you need to get product through quickly (M. Riordan, personal communication, January 18, 2005).

> There are more things a RAW format user needs to understand now, such as color management, batch processing, Camera RAW functions, file browser, and end product requirements (G. Barnett, personal communication, January 20, 2005).

The experts also concurred that the RAW format should not be used without proper knowledge, especially in a large organization. In their experience, problems occurred when the photographer did not understand what RAW is all about. The photographer needs to understand the workflow before attempting to use RAW. A photographer in a publishing environment who intends to use a RAW workflow must get proper training, education, and support to make it work. Interviewee Franziska Frey

stated, “If you have control, you need to take decisions on what to do. You need to have knowledge… that is where [RAW] either works or doesn’t work” (F. Frey, personal communication, February 23, 2005).

> It could be practical to use RAW in publishing if you take the time to set the workflow correctly and have the automation in place. But then it’s still come down to [the] productivity question. If you’re not gaining something in the process, is it worth making that adjustment… changing the workflow (G. Barnett, personal communication, January 20, 2005)?

Another disadvantage, as stated previously, is that there is no standardized RAW format. Currently, all camera manufacturer versions of RAW are different. Versions differ even among cameras of the same manufacturer. Currently there are about 70 to 80 different RAW formats. Some formats used in earlier cameras are no longer supported. Standardization might help in the short term, but this will occur anyway with changes in technology, unless data migration is done. Futhermore, unless batch processing or automation is used, the RAW process can be very slow. In a high-speed production situation a photographer may be better off using the JPEG format just because the images are more quickly available.

> If you don’t know how to use batch processing and automation, then it can be very slow. It takes more knowledge for you to be able to use RAW effectively. I treat RAW pretty much like I treated shooting with film because I needed to know what I was doing before I went out and shot it (G. Barnett, personal communication, January 20, 2005).

Is RAW Workflow Suitable to Produce Tens of Thousands of Images Monthly?

Some of the experts said that RAW is suitable when the user has the time, knowledge, proper equipment, and the right software. It also depends on the required end result. The experts agreed that, for a product catalog with small images, for example, there would be no advantage to using RAW: JPEG images would be satisfactory.

A few of the experts said that RAW could work in any situation but that one has to weigh the time factor. If time is important and quality is not the highest priority, then sacrificing a bit of quality in the interest of speed can be considered. To be able to process large numbers of images, a publisher would need to install powerful computers and have operators who are trained and set up to do the processing and who can control the situation. Processing should be automated in order to meet deadlines. Success relies on the workflow setup and having people follow the procedure properly.

Is RAW Workflow Suitable for Any End Product? Under Which Circumstances Should People Use RAW?

There are different opinions on whether RAW workflow is suitable for every end product. These opinions depend on the situation the photographer is in and on the end product's requirements. RAW is suitable when the image is to be used in a variety of different publications, such as high-quality magazines, posters, and the Internet. For time-sensitive work like photojournalism, however, quality images are less important than speed. Interviewee Franziska Frey stated, "You have to look at both [quality and time]. In

publishing you have to look at what is good enough for your market" (F. Frey, personal communication, February 23, 2005). JPEG is more suitable if the photographer is shooting photojournalism or sports where it is necessary to work fast. The photographer must decide whether capturing the moment is more important than having the functionality of a RAW file. In situations where images are pushed to production for immediate publication, RAW does not provide any advantages. In photojournalism, RAW might be suitable from a quality standpoint but not from the standpoint of time efficiency. In advertising, on the other hand, RAW would be an advantage if the job is not time-sensitive and high-quality images are required.

> There's one situation when a friend working for a newspaper shot a hockey game and had only 30 minutes until press time to get the images to press. He got the shots he needed, downloaded them to his computer and sent them to the newspaper. They worked the files and made it to plate just before printing started. With that window, if you were using RAW workflow, you would need more process time and might not have it ready in time for the production (M. Riordan, personal communication, January 18, 2005).

When images are to be used only for the Internet, RAW is unsuitable. If the photographer has limited camera memory, the file must be small, and if time is short, shooting a JPEG would be the better choice. One expert said that if the quality that one requires for the end product could be met with JPEG, then from an economic point of view it probably makes sense to stay with the JPEG file format.

Interviewee responses:

> Most photojournalists are going to shoot JPEG because they want the shot and they do not have to worry about RAW processing. They need to basically capture the moment and push them for production. For editorial photography versus advertising photography, there are two different worlds. RAW is suitable from a quality standpoint but its efficiencies are questionable. [The question is:] 'Am I going to be able to handle the volume [with all RAW images efficiently]?' and the answer is 'probably not.' In any situation, there is not a clear case of whether you need to go to RAW or not. We have to look into time and quality differences and whether it is worth the time difference because time is money (M. Riordan, personal communication, January 18, 2005).
>
> If I were a reporter and I was shooting something and I was going to immediately send it to the paper, shooting a JPEG might be wise. In that sense quality does not matter as much as speed (J. Retallack, personal communication, January 25, 2005).
>
> RAW is not suitable for a photojournalist who is going to transmit images. A photographer needs to make visual decisions based on RAW or JPEG files, but a journalist needs to send JPEGs. Photographers used to go shoot and look at the transparencies on the light box and said that it is beautiful. Then the publisher will take the photo and turn it into a reproduction image. But now the photographer needs to know, will my photos have enough information for these deliverables whether it's halftone, continuous tone, or inkjet (D. Rea, personal communication, February 3, 2005).

Chapter 6

Summary and Conclusions

Digital photography was initially adopted in most publishing houses in order to produce images instantly and to shorten the production time. Not having to wait for chemical processing of films, to scan hundreds of images daily, and to do hours of image retouching is good reason for publishers to adopt the technology. However, to start using a digital camera, photographers have to know their end product so that they can set their camera accordingly.

RAW file formats are not new, but during the past few years, digital camera users are becoming more interested in using the format. This interest has led to the development of better cameras, bigger and faster storage cards, better applications such as Adobe Camera RAW, Capture One, Bibble, SilverFast DCPro, and better workflow. RAW has opened a new perspective for digital photography: maintaining control over the digital images. Professional photography has always been about producing high-quality images. However, the quality of digital images produced by JPEGs was not acceptable for most professional photographers. Photographers are now looking at RAW capabilities, and some have been using it in their daily work.

RAW gives the user the freedom to craft his or her digital image and produce a high-quality photograph. Most photographers who use RAW use it as a security measure. It is said that if the photographer shoots RAW and something should go wrong with the image, it can be fixed later in Photoshop CS. This statement is not entirely correct. Photography is still the same. All of the photographic techniques – setting the ISO and aperture, determining white point, using a gray card, still apply. Digital photography was designed to make photography faster and easier, but the fundamentals are still the same, and in order to produce a good image, a photographer still needs to apply photographic knowledge no matter which file formats are used. If the camera settings are correct in the beginning of the photography session, then the photographer can achieve high-quality images using JPEG. Shooting the image properly at the beginning and avoiding later image adjustment, saves time and pixel data (Adobe.com, 2004). In magazine publication, images are needed in large numbers. Most of the time, not all of the images shot are used in the publications.

The big problem today is that a lot of people are skipping the learning process before using RAW. RAW workflow implementation requires more effort and time, and requires more from the photographer and the camera: more storage cards, servers for images, upgrading of computer equipment, software, and knowledge and expertise in camera function, end products, and the proper workflow. The RAW workflow has to be monitored, and an image editor and processors are needed to accommodate the workflow (Fraser, 2005).

Magazine Publishing Needs

JPEG and TIFF images have been used in a wide variety of magazine publications. In most publishing environments, time is more valuable than quality. If the customers are satisfied with the magazine's current quality, then the publishers needn't worry. Publishers have to look into whether switching to RAW will provide a return on their investment in the new technology. Magazine publishing is all about making money, and any technology the publisher is going to adopt must ensure a growth in income. The RAW file format provides flexibility for the user, and the multi-purpose aspect of the RAW format provides advantages for different kinds of publication use. However, publishers need to justify whether RAW usage is appropriate for their final product. Following the industry trends, the standard file format used for photojournalism depends on the final product needs and the situation the photographer is in at the moment. Photojournalists shooting fast-moving events or sports would do best to use JPEG. For other, slower types of events, they might use TIFF. This is because JPEG produces fast images at an acceptable quality level. TIFF produces high-quality images, which can be use instantly but at a slower write rate. Based on the findings, RAW is not appropriate for use in a magazine publishing environment, given the current workflow and current needs (Fraser, 2005).

Recommendations

The author has analyzed the responses of working professionals and has established a suggested objective guideline for the use of RAW capture workflow in magazine publishing applications.

When to Use RAW

To implement the RAW format in a magazine publishing company, one must look at the global workflow of the company. Tests should be done in order to see whether the RAW workflow is compatible with the existing production workflow and whether it provides any benefits over JPEG. Implementation should be applied to one magazine at a time, beginning with a monthly magazine, for which the deadline is not as crucial as it is for a weekly magazine. In general, issues surrounding the decision on whether to use RAW or JPEG depends on the user's needs. If quality is not the highest priority, for example, if the images will be small and printed in a catalog or if they will be used on the Internet, then there is no need to use RAW. Knowing the end product beforehand makes it easier to determine which file format to use. Table 3.0 outlines conditions when JPEG and RAW are best used.

Table 3.0:
When to Use RAW and JPEG

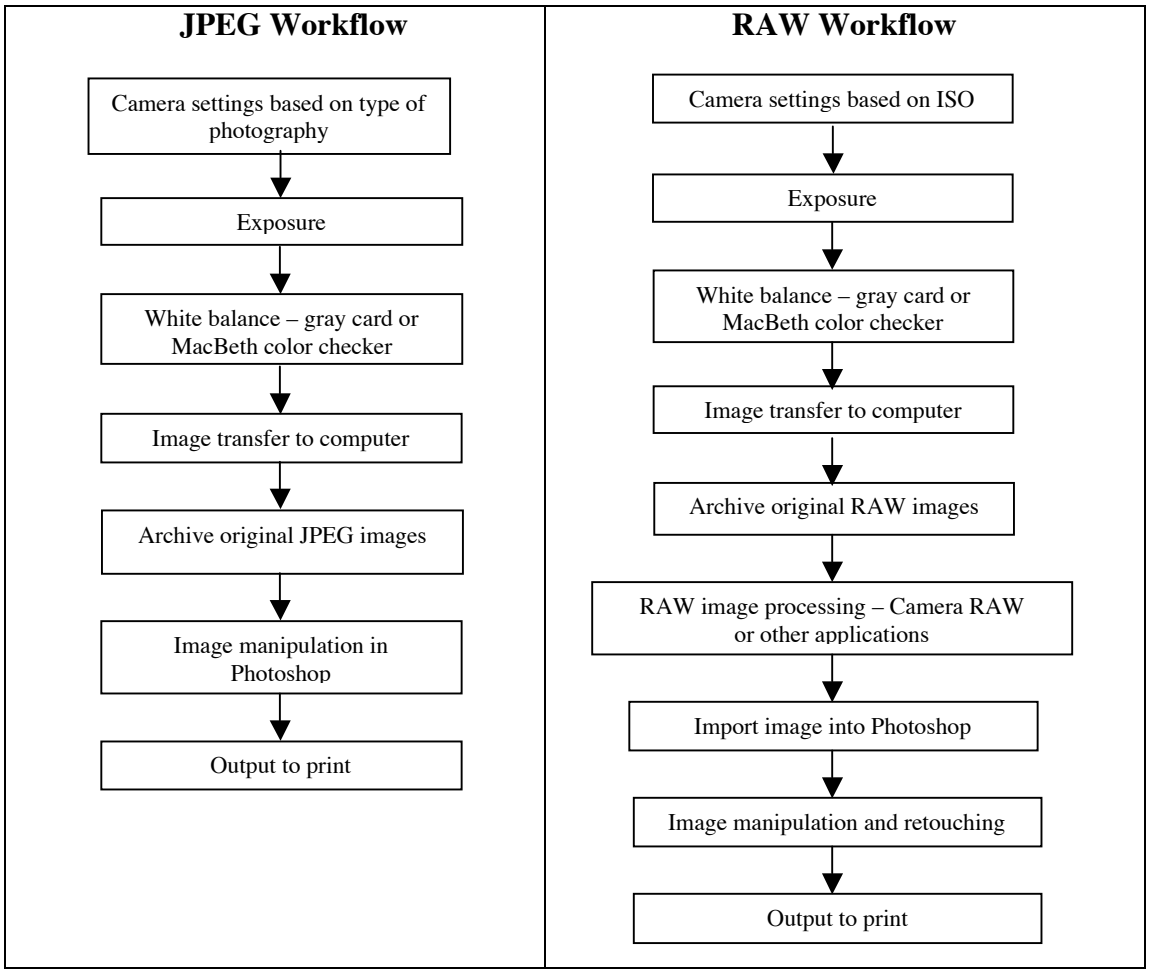
RAW	JPEG
1. To achieve the highest image quality 2. For multi-purpose-use image 3. When there is time to process images 4. When there are no tight deadlines 5. When there is ample time for image capture 6. To have the flexibility to adjust images according to preference 7. After knowledge in RAW workflow and batch processing has been acquired 8. If extra people to handle processing of images are available 9. If the RAW workflow is compatible with the current workflow and end product 10. If the company is prepared to invest a significant amount of money for upgrading equipment and software	1. When quality is not of paramount importance 2. For photojournalism work 3. When working with tight deadlines 4. If the image is to be used instantly 5. When in-camera image processing is satisfactory for the user's intent 6. If image transfer must be done quickly 7. When small images are needed 8. For images used on the Internet only 9. When capturing the moment is more important than quality 10. If the company is not prepared for a major change in workflow

Comparison Between JPEG and RAW Workflow

Table 3.1 shows the differences between JPEG and RAW workflows. Both workflows are similar except for the additional steps in the RAW workflow for image processing and importing images into Photoshop. The additional steps involve extra time.

Image processing in Camera RAW involves choosing the white balance, picture depth (8 or 16 bits per channel), resolution, color space, size, sharpening, exposure, brightness, and shadows, depending on the processor's needs (see appendix 3). Most of the time, the processor will choose to do minimal image enhancement in Camera RAW. Image enhancements are done mostly in Photoshop.

Table 3.1:
Comparison Between JPEG and RAW Workflow



Suggested File Format for Publishing Application

In publishing, each magazine has different requirements. Table 3.2 illustrates some of the photographic applications with their image-quality and file-size needs, together with the file formats that are suitable for use in the magazine publishing workflow. These are suggested options, but they could change, depending on the situation the photographer is in at the moment. The photographer has to make the decision on the spot based on the work, storage card availability, camera capability, and the end product. All of the decisions made before the photography session will impact the future use of the images.

For example, for a cover shoot, high image quality is needed. However, it always depends on the magazine's needs. For example, for an entertainment tabloid magazine, quality usually is not as crucial as having an image. In this situation, the photographer could shoot a picture using JPEG format to ensure that he or she will not miss a shot. A fashion shoot could involve shooting a still subject in a studio or a moving subject at a fashion show in the field. In these situations, the photographer needs to choose the best file format to accommodate the subject and the end product. RAW might not be suitable for a fashion show because it might not allow the photographer to capture every move, which might limit picture choices later on. The choice would also be based on the level of time sensitivity of each image.

Table 3.2:
Suggested Application According to Time and Needs For Magazine Publication

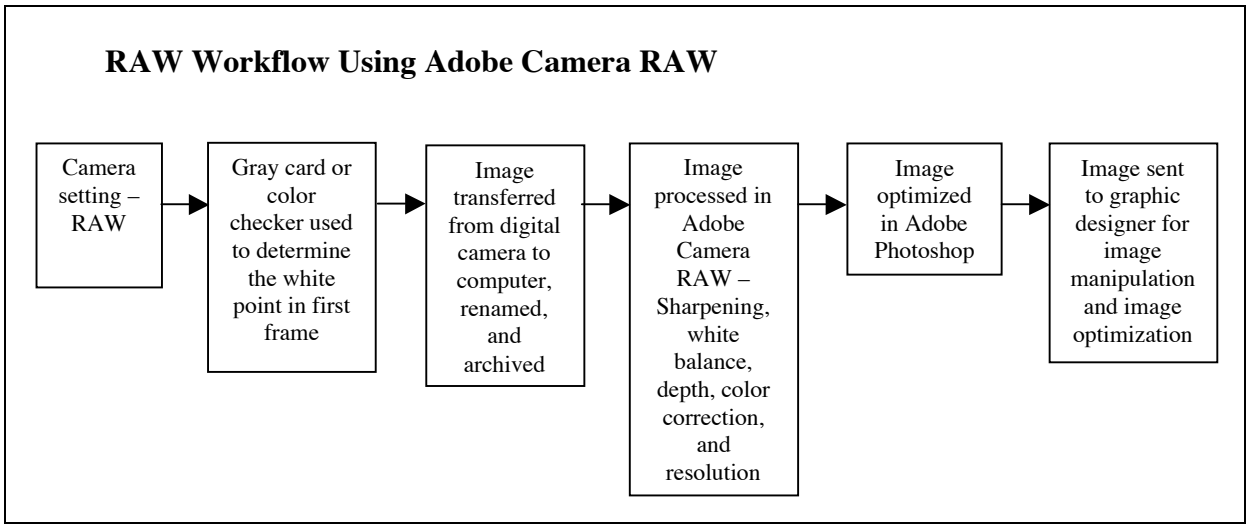
Photographic Application	Image Quality Needed	File Size Needed	RAW / JPEG / TIFF
Cover	High	Large	RAW / JPEG / TIFF
Fashion	High	Large / Small	RAW / JPEG / TIFF
Food	High	Large / Small	RAW / TIFF
Interior	High	Large	RAW
Still life	Variable	Large / Small	RAW / TIFF
Sports	Variable	Large / Small	JPEG
Portrait	Variable	Large / Small	JPEG / TIFF
Journalism	Low	Small	JPEG
Travel	Variable	Large / Small	JPEG
Nature	High	Large	JPEG / TIFF
Panoramic	High	Large	RAW
Architecture	High	Large	RAW

Suggested RAW Workflow

Table 3.3 illustrates the basic RAW workflow using Adobe Camera RAW. As stated previously, before any photography session, the photographer needs to know what the end product will be. The photographer has to bear in mind that to produce a good photograph depends not only on the file format but also on the initial settings and his or her own knowledge and experience. RAW workflow within Camera RAW can be shaped according to the processor's need. Some processors may do a lot of image enhancement during processing in Camera RAW and some may do it in Photoshop. Either way, the processor needs to spend time on the image. For every photography session, a gray card or a color checker is needed to determine the white point. It is usually shot in the first frame. After the photography session, images are transferred from the storage cards or the

camera to the computer. Images should be archived first for backup purposes. Images should then be renamed according to the magazine, issue, or event for image management. Images are then processed using a RAW converter such as Camera RAW (see appendix 2). Adobe Camera RAW is convenient because it operates within Adobe Photoshop CS, a common application in the graphic arts industry, and because, after RAW conversion, images need to be opened in Photoshop for additional image optimization. Using a single software application to do RAW conversion and manipulation avoids confusion and saves time.

Table 3.3:
RAW Workflow Using Adobe Camera RAW



Summary

Magazine publishing is a high-speed-production situation where time management is a crucial factor. After looking into the pros and cons of RAW, the author has come to the conclusion that currently it is not practical to use digital camera's RAW

data in print publishing applications. It requires a significant amount of time for the photographer to learn about the format's functions, to process the files, to understand the workflow, and to learn about the end products, at the same time, taking full advantage of all that the format offers and making sure that the magazine can still be produced on time without any problems. However, efforts are being made towards making RAW format more "user-friendly" and easy to use. RAW will be easier to implement by the new generation of photographers who have already been exposed to the format and have greater knowledge in technology and more computer savvy. Publishers should start investigating ways in which RAW use can positively affect the company's profits. In the future, RAW might be the first choice for publishers, but it is yet to be proven.

Chapter 7

Recommendations for Further Investigation

RAW file format produces superior high-quality images, provided the user knows how to use it. Its tools in the hands of an expert user are powerful, but in the hands of average photographer might be disappointing and a waste of time. Adobe is playing an important role in supporting the use of RAW file format by developing the RAW conversion application, Camera RAW. A large number of RAW users have been using Camera RAW to convert their images instead of the camera manufacturer's software. This is because the tools provided by Camera RAW are faster and better. Camera RAW also supports various kinds of RAW formats, which makes it easier for users.

RAW file format usage is still in the early stages, and a lot of people are still in the process of understanding its functions, and its capabilities and when to use it. Since RAW usage is still progressing, the author suggests that within three to five years the type of investigation done for this thesis should be done again to see whether or not RAW workflow has evolved in a way that eliminates the time problem that currently makes RAW inappropriate for use in the high-speed production situation in publishing. It would also be useful to interview people working in the magazine publishing industry to get

better feedback on RAW usage. By then, RAW might be utilized in most publishing houses. This depends on how the technology supporting the RAW workflow evolves. Now, a lot of manufacturers are working on making faster storage cards, faster cameras, and better RAW converters. All of these changes might overcome the disadvantages of the RAW format. Adobe has launched Digital Negative converter, which is said to be the tool for a standard RAW format. Digital Negative converter is still in the early stages and its progress should be monitored to determine its capabilities. Another file format being introduced to the industry is JPEG2000. JPEG2000 is said to be a solution to the JPEG lossy compression issue, as it is said to be lossless. JPEG2000 is not yet on the market but an investigation should be done on the probability that JPEG2000 will become the format of choice, especially for photographers in the publishing industry.

Users have always talked about the RAW standard. Future investigation should be done on the topic of a RAW standard file format, when and how will it happen, and whether it will have any impact on the publishing workflow. Other questions to address might be what are the advantages of using the standard RAW format in publishing? Is there any workflow or system to automatically handle the images instantly after downloading them from the camera? The author also recommends that research be done on the types of digital images that are suitable for magazines of different quality. Research could also be done on the topic related to digital camera evolution and its impact on the print publishing industry.

Professional photographers frequently talk about quality differences between RAW and JPEG file formats. Many claim that RAW formats provide higher quality results than JPEG. Some claim that JPEG can deliver equally high quality images and some claim that TIFF format provide higher quality images than JPEG. However in this thesis research, the author did not get a clear answer on the quality differentials among the various image formats. There is a clear need for objective research comparing the capabilities of the various image formats to produce high quality printed results.

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GLOSSARY

Glossary

CCD Charge Coupled Device: a mechanism that converts light into a proportional (analog) electrical current; one of the two main types of image sensors used in digital cameras.

CMOS Complementary Metal-Oxide Semiconductor: one of the two main types of image sensors used in digital cameras. Its basic function is the same as that of a CCD. CMOS sensors are currently found in only a handful of digital cameras.

compression A generic term to describe one of the numerous processes whereby data or details are removed from an image to make the overall image size smaller.

DNG The Digital Negative (DNG) specification describes a generalized way of storing the raw data created by any digital camera. Adobe Systems Incorporated, who already has experience supporting a wide range of different camera-specific formats within the Camera RAW plug-in for Adobe Photoshop CS, wrote the specification. The format was designed to support a wide range of variations in camera design and features.

EXIF EXIF (Exchangeable Image File) is a standard for storing information created by JEIDA (Japan Electronic Industry Development Association) to encourage interoperability between imaging devices. Besides information about the pixels of the image, most cameras store additional information such as the date and time the image was taken, aperture, shutter speed, ISO, and most other camera settings, these data also known as "metadata".

JPEG2000 JPEG2000 is a “lossless” image format when designated as such in the software. As JPEG2000 becomes available, this may be the format of choice. This format would be compressed but lossless (like TIFF).

lossy compression This compression method minimizes file size by eliminating unnecessary data, which causes a slight degradation of image quality.

lossless compression This compression format minimizes the size of files by creating internal shorthand, which restores the image to its original state before compression. For example TIFF is a lossless compression format.

metadata Metadata is data about data. It’s information that goes with a file and describes what the contents of the file are, where it came from, and what to do with it.

pixel A single dot within a digital photograph. The typical photograph is made up of thousands of pixels.

posterization The effect produced when a photographic image is displayed or printed with a small number of colors or shades of gray.

prosumer Prosumer is the combination of the words “professional” and “consumer”, to describe a halfway point in digital cameras between amateur and professional.

white balance Digital cameras have the ability to adjust the color based on the lighting situation where they are used. This is known as white balance. The cameras use white as a reference and adjust the color balance to give as true as possible a white, correcting all the other colors by doing this.

APPENDICES

APPENDIX A

Appendix A

Interview Guide

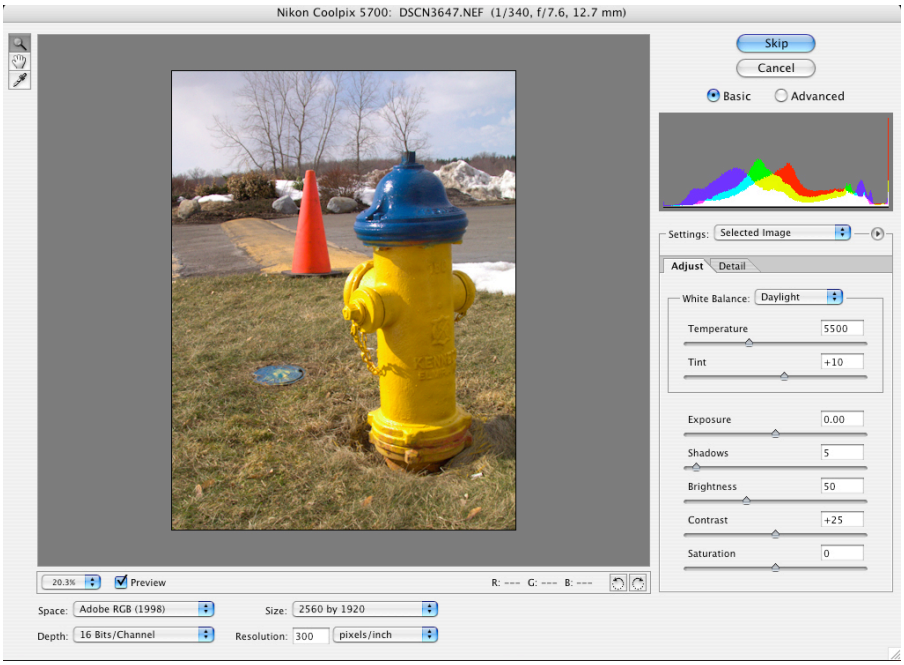
1) Were you using JPEG before? YES / NO
   a. Did you switch to RAW? YES / NO
   b. If yes, why?
   c. Have you specifically observed image quality improvements since you started using RAW data? If yes, please explain, with one example, when this occurred.
   d. Can you explain the differences between RAW and JPEG.
2) Does RAW workflow apply to all digital camera users? YES / NO. If yes, why?
3) What can you do with RAW files that you cannot do with JPEG?
4) Which digital camera do you most often use? Are there any differences between cameras for RAW files?
5) Whose RAW processing software do you use? (Please name specific product)
6) In your opinion, what is the PRIMARY advantage of capturing images in RAW format (as opposed to JPEG)?
7) In your opinion, what is the PRIMARY disadvantage of capturing images in RAW format (as opposed to JPEG)?
8) Is RAW workflow suitable for producing tens of thousands of images monthly?
9) Is RAW workflow suitable for ANY end product (e.g. newspapers, magazines)? Under which circumstances, should I use RAW?

10) What is your primary output? Do you use the same workflow for all of your end products?
11) If you were shooting images that were intended for final publication in a magazine, would you use RAW or JPEG capture? Please explain your reasoning.
12) When shooting pictures for your professional work using a digital camera, briefly explain your workflow from capture to output. Use an application of your choice as an example.
13) Given a choice of only ONE format for ALL your photography, would you use RAW or JPEG? Please explain your reasoning.

APPENDIX B

Appendix B

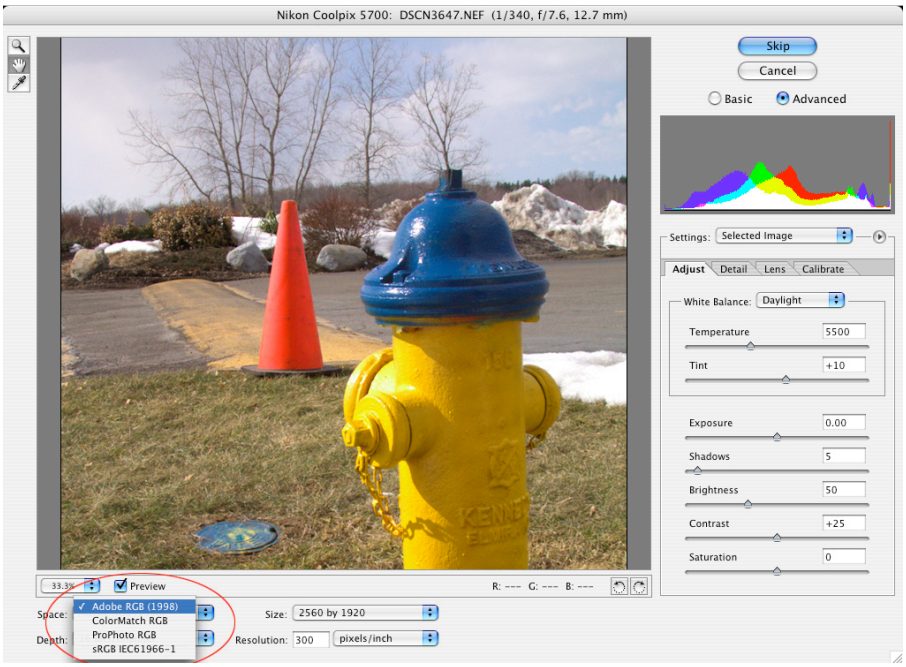
Adobe® Camera RAW



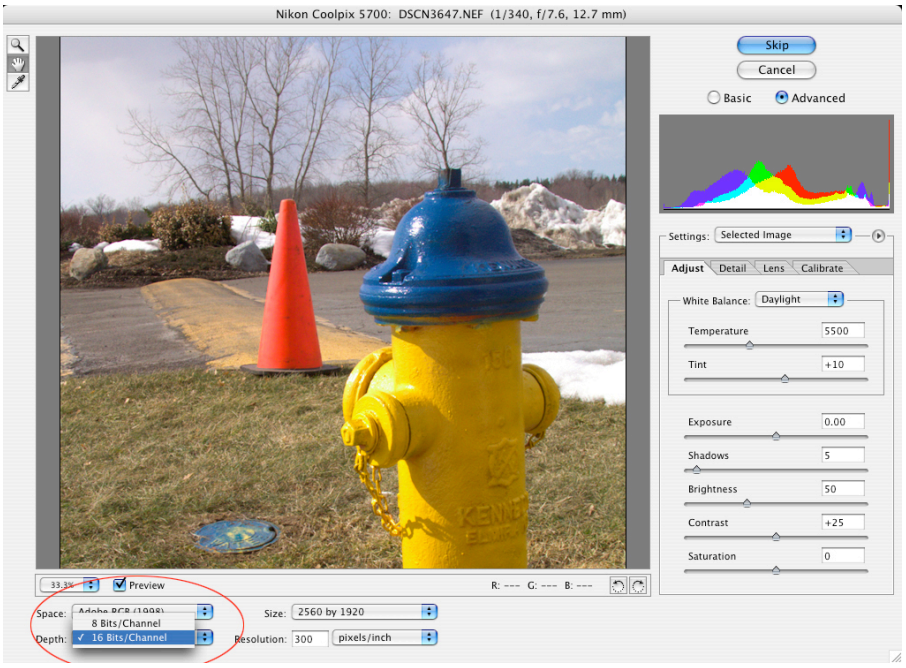
APPENDIX C

Appendix C

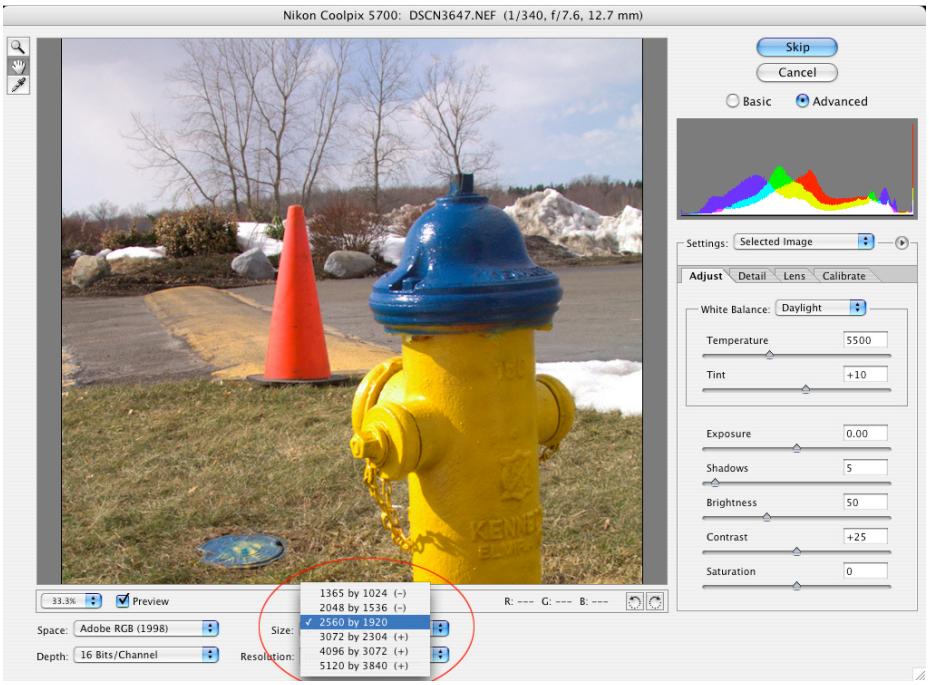
Adobe® Camera RAW Tools



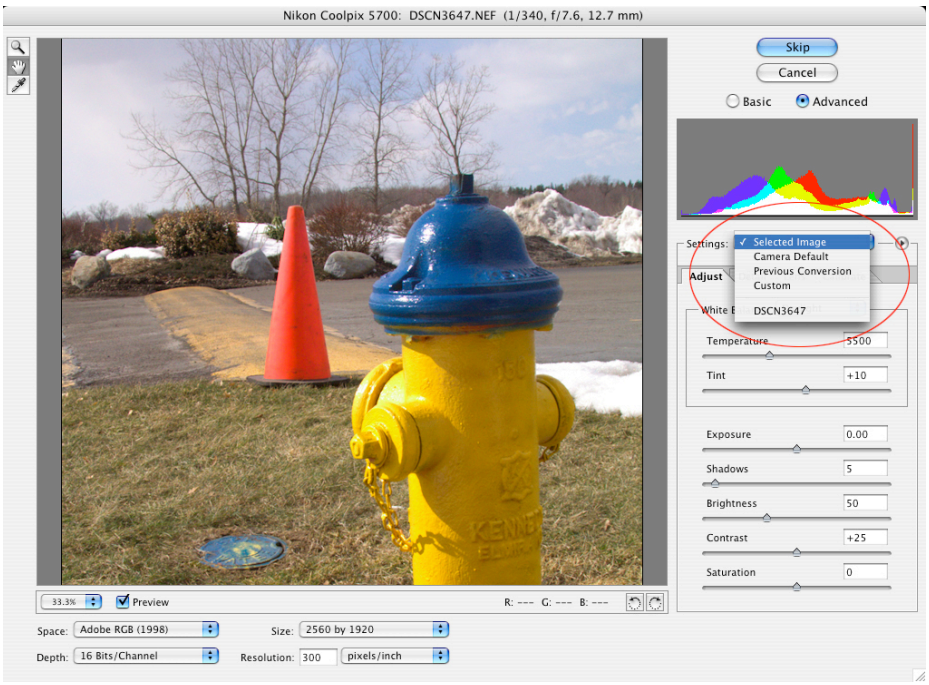
Color Space



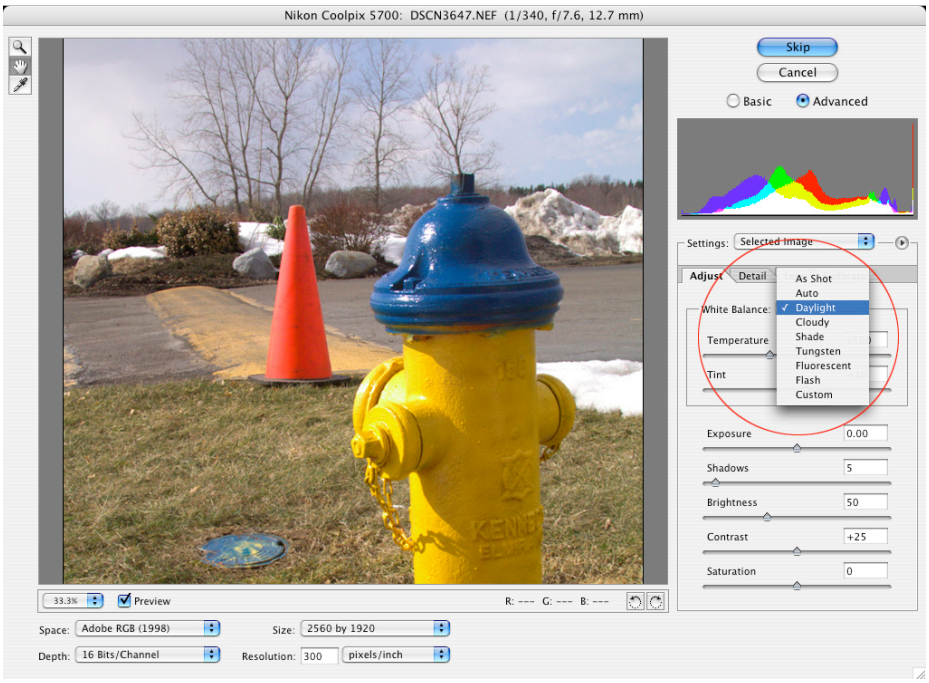
Picture Depth



Size



Settings

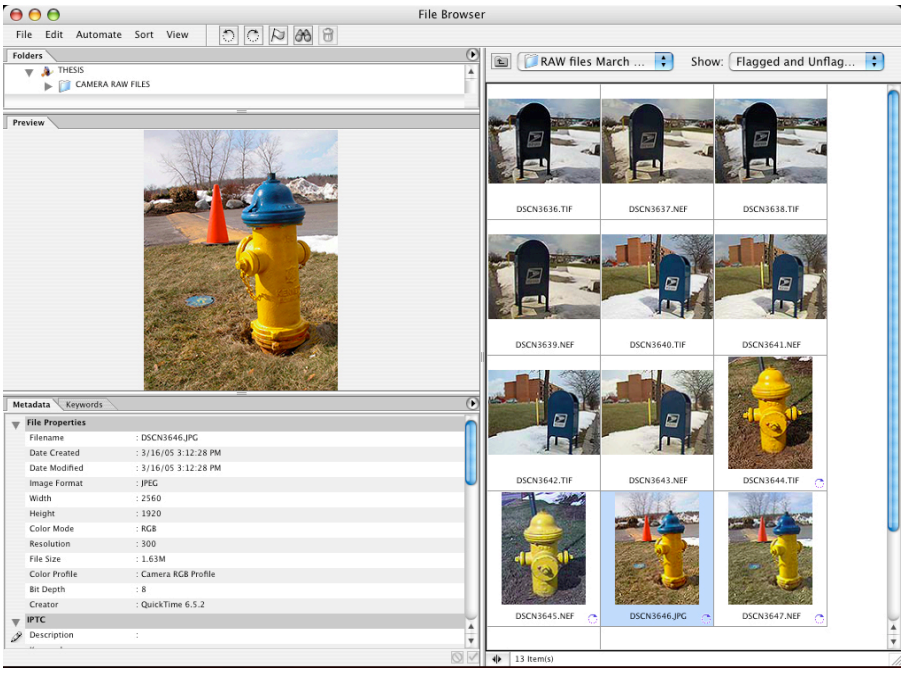


White Balance

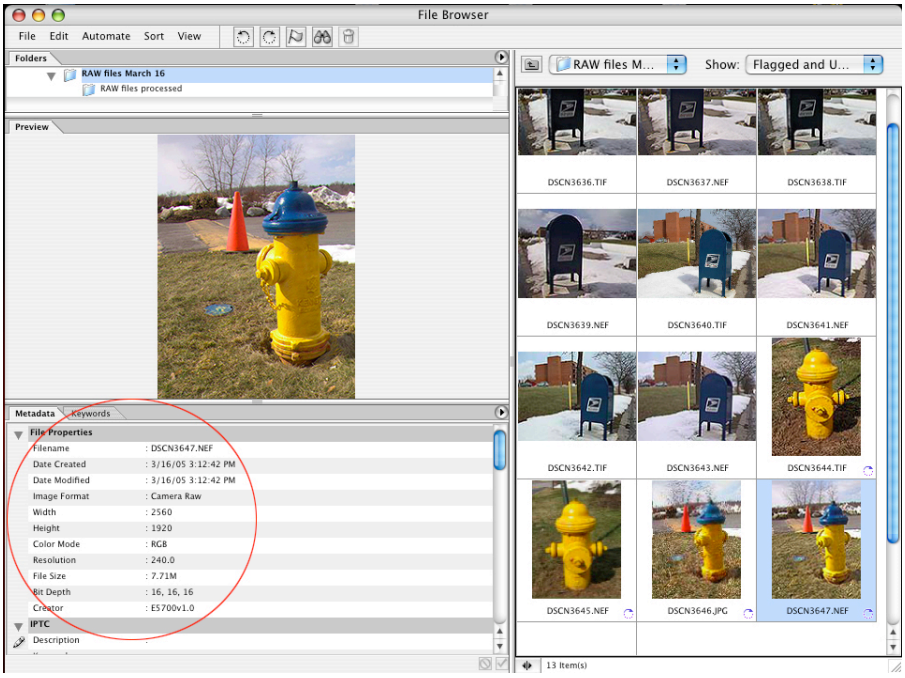
APPENDIX D

Appendix D

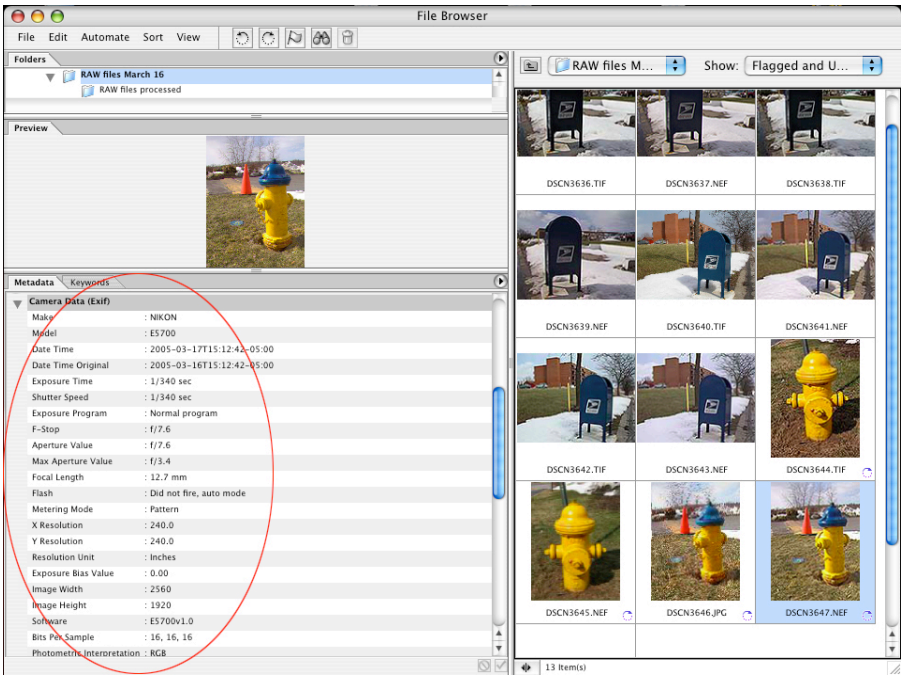
File Browser Interface and Information



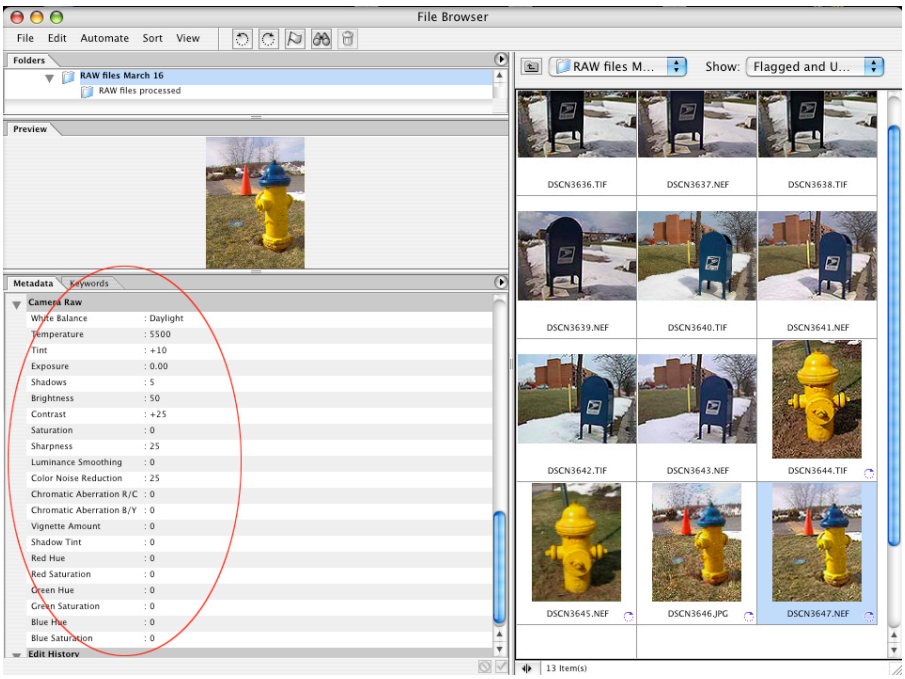
File Browser



Metadata



Metadata - EXIF



Camera Raw Data